variations as fall within the broad scope of the appended claims.

WHAT IS CLAIMED IS:

1. A nickel base superalloy comprising 3.0 to 12 wt% chromium, up to 3.0 wt% molybdenum, 3.0 to 10 wt% tungsten, up to 5.0 wt% rhenium, 6.0 to 12 wt% tantalum, 4.0 to 7.0 wt% aluminum, up to 15 wt% cobalt, up to 0.05 wt% carbon, up to 0.02 wt% boron, up to 0.1 wt% zirconium, up to 0.8 wt% hafnium, up to 2.0 wt% niobium, up to 1.0 wt% vanadium, up to 0.7 wt% titanium, up to 10 wt% of at least one element selected from the group consisting of ruthenium, rhodium, palladium, osmium, iridium, platinum, and mixtures thereof, and the balance essentially nickel, said nickel base superalloy having a microstructure which is pore-free and eutectic $\gamma - \gamma'$ free.

2. A nickel base superalloy according to claim 1, wherein said microstructure has a gamma prime morphology which includes a bimodal γ' distribution.

3. A nickel base superalloy according to claim 2, wherein said bimodal γ' distribution includes a uniform distribution of large γ' precipitates in a continuous gamma matrix and a second and uniform distribution of fine γ' particles.

4. A nickel base superalloy according to claim 3, wherein said large γ' particles are octet shaped and have an average particle size in the range of 1.0μ to 20μ and the fine γ' particles are cuboidal particles and have an average particle size in the range of from 0.45μ to 0.55μ.

5. A nickel base superalloy according to claim 1, wherein said nickel base superalloy is a single crystal nickel base superalloy.

6. A single crystal nickel base superalloy having a microstructure which is pore-free and eutectic $\gamma - \gamma'$ free and which has a gamma prime morphology which includes a bimodal γ' distribution.

7. A single crystal nickel base superalloy according to claim 6, wherein said bimodal γ' distribution includes large γ' particles having a particle size in the range of from 1.0μ to 20μ and fine γ' particles.

8. A single crystal nickel base superalloy according to claim 7, wherein said large γ' particles are present in an amount from 25 vol% to 50 vol%.

9. A single crystal nickel base superalloy according to claim 7, wherein said large γ' particles are present in an amount from 27 vol% to 45 vol%.

10. A single crystal nickel base superalloy according to claim 7, wherein said fine γ' particles have a particle size in the range of from 0.45μ to 0.55μ.

11. A single crystal nickel base superalloy according to claim 7, wherein said large γ' have an octet shape and said fine γ' particles have a cuboidal shape.

12. A process for forming an improved nickel base superalloy comprising the steps of:

casting an object formed from a single crystal nickel base superalloy having a microstructure;

closing any as-cast microporosity and partially solutioning eutectic $\gamma - \gamma'$ phase islands in the microstructure of said single crystal nickel base superalloy;

fully solutioning any eutectic $\gamma - \gamma'$ phase and precipitating a uniform distribution of large γ' particles in the microstructure; and

forming fine γ' particles in the microstructure to improve the strength of the nickel base superalloy.

13. A process according to claim 12, wherein said casting step comprises casting a single crystal nickel base superalloy having a composition comprising 3.0 to 12 wt% chromium, up to 3.0 wt% molybdenum, 3.0 to 10 wt% tungsten, up to 5.0 wt% rhenium, 6.0 to 12 wt% tantalum, 4.0 to 7.0 wt% aluminum, up to 15 wt% cobalt, up to 0.05 wt% carbon, up to 0.02 wt% boron, up to 0.1 wt% zirconium, up to 0.8 wt% hafnium, up to 2.0 wt% niobium, up to 1.0 wt% vanadium, up to 0.7 wt% titanium, up to 10 wt% of at least one element selected from the group consisting of ruthenium, rhodium, palladium, osmium, iridium, platinum, and mixtures thereof, and the balance essentially nickel.

14. A process according to claim 12, wherein said closing and partially solutioning step comprises subjecting said cast object to hot isostatic processing at a final temperature in the range

of from 2145°F to 2625°F for a time period in the range of from 3.5 hours to 4.5 hours at a final pressure in the range of from 13 ksi to 16.5 ksi.

15. A process according to claim 14, wherein said hot isostatic processing step is carried out at a final temperature in the range of 2195°F to 2565°F and at a final pressure in the range of from 14 ksi to 16 ksi.

16. A process according to claim 14, wherein said hot isostatic processing step further comprises bringing the cast object from room temperature to a first temperature in the range of from 2075°F to 2550°F at a rate of from about 5.4 to 6.6°F/min, from the first temperature to a second temperature in the range of 2125°F to 2595°F at a rate of from 0.4 to 0.6°F/min, and from the second temperature to the final temperature at a rate of 0.05°F/min to 0.15°F/min.

17. A process according to claim 14, wherein said hot isostatic processing step further comprises bringing the cast object from room temperature to a first temperature in the range of 2115°F to 2485°F at a rate of from 5.5 to 6.5°F/min., from the first temperature to a second temperature in the range of from 2170°F to 2550°F at a rate in the range of from 0.45 to 0.55°F/min, and from the second temperature to the final temperature.

18. A process according to claim 14, wherein said hot isostatic processing step further comprises raising the pressure from substantially 0 psi to a first pressure in the range of from 4.5 to 5.5 ksi at a rate in the range of 0.01 ksi/min and then raising the pressure from the first pressure to the final pressure at a rate in the range of 0.03 ksi/min. and holding the

final pressure for a time period in the range of from 2.5 hours to 3.5 hours.

19. A process according to claim 12, wherein said fully solutioning and precipitating step comprises subjecting the cast object to a solution heat treatment step.

20. A process according to claim 19, wherein said solution heat treating step comprises bringing the cast object from room temperature to an initial temperature in the range of from 1625°F to 2000°F at a temperature ramp rate in the range of from 30°F/min. to 40°F/min., taking the cast object from the initial temperature to a second temperature in the range of from 2075°F to 2525°F at a temperature ramp rate in the range of 7.5°F/min. to 9.0°F/min., taking the cast object from the second temperature to a third temperature in the range of from 2100°F to 2575°F at a temperature ramp rate in the range of 1.0°F/min. to 2.0°F/min., taking the cast object from the third temperature to a fourth temperature in the range of 2130°F to 2600°F at a temperature ramp rate in the range of from 0.9°F/min. to 1.1° F/min., taking the cast object from the fourth temperature to a fifth temperature in the range of from 2145°F to 2625°F at a temperature ramp rate in the range of from 0.4°F/min. to 0.6°F/min., taking the cast object from the fifth temperature to a sixth temperature in the range of from 2150°F to 2650°F at a temperature ramp rate in the range of from 0.2°F/min. to 0.4°F/min., and taking the cast object from a sixth temperature to a seventh temperature in the range of from 2190°F to 2675°F at a temperature ramp rate in the range of 0.15°F/min. to 0.25°F/min.

21. A process according to claim 20, wherein the solution heat treating step further comprises holding the cast object at said

seventh temperature for a time period in the range of 5 hours to 6.5 hours, decreasing the temperature of said cast object from said seventh temperature to an eighth temperature in the range of from 1975°F to 2425°F at a cool down rate of 0.9°F/min. to 1.1 F/min., and decreasing the temperature of said cast object from said eighth temperature to room temperature at a minimum cooling rate in the range of from 100°F/min. to 125°F/min.

22. A process according to claim 12, wherein said forming fine γ' particles step comprises precipitation heat treating the cast object by heating the cast object to a treatment temperature in the range of from 1175°F to 1450°F, holding the cast object at said treatment temperature for a time period in the range of 20 hours to 30 hours, and then air cooling the cast object.

23. A process according to claim 22, wherein said heat treating step comprises heating the cast object to a temperature in the range of from 1200°F to 1400°F and holding the cast object at said treatment temperature for a time period in the range of 22 hours to 26 hours.

24. An object formed from a single crystal nickel base alloy having a microstructure which is pore-free and eutectic $\gamma - \gamma'$ free and which has a gamma prime morphology with a bimodal γ' distribution.

25. An object according to claim 24, wherein the bimodal γ' distribution includes large γ' particles having an average particle size in the range of from 1μ to 20μ and fine γ' particles having an average particle size in the range of from 0.45μ to 0.55μ.

26. An object according to claim 24, wherein said nickel base alloy has a composition comprising 3.0 to 12 wt% chromium, up to 3.0 wt% molybdenum, 3.0 to 10 wt% tungsten, up to 5.0 wt% rhenium, 6.0 to 12 wt% tantalum, 4.0 to 7.0 wt% aluminum, up to 15 wt% cobalt, up to 0.05 wt% carbon, up to 0.02 wt% boron, up to 0.1 wt% zirconium, up to 0.8 wt% hafnium, up to 2.0 wt% niobium, up to 1.0 wt% vanadium, up to 0.7 wt% titanium, up to 10 wt% of at least one element selected from the group consisting of ruthenium, rhodium, palladium, osmium, iridium, platinum, and mixtures thereof, and the balance essentially nickel.